

Report of the Subcommittee on Environmental Information for Select OCS Areas Under Moratoria

Report to the OCS Policy and Scientific Committees of the Minerals Management Advisory
Board

Charter

This Subcommittee on Environmental Information for Select OCS Areas Under Moratoria is jointly established by the Outer Continental Shelf (OCS) Policy Committee and OCS Scientific Committee of the Minerals Management Advisory Board. The purpose of this subcommittee is to independently review and evaluate specific information needs for OCS areas where controversy has led to executive or legislative restrictions on leasing.

This assessment by the subcommittee will help guide the Secretary of the Interior and the Minerals Management Service in identifying environmental information needs and therefore the scope of studies required to fill in information gaps identified by the National Academy of Sciences in its review of the Environmental Studies Program (ESP). Specifically, the aim of the subcommittee's efforts is to assist the Department and the Bureau to more efficiently and effectively focus MMS research funds to address those questions that are critical to OCS program decisions.

The subcommittee will assess environmental information and studies requirements in light of ESP budgetary constraints, offshore oil and natural gas state-of-the-art technology, the offshore industry's environmental record, industry interest, and the nature of the potential hydrocarbon resources in the areas under review (i.e., oil versus natural gas). The subcommittee may also identify and evaluate alternative strategies such as mitigation measures and stipulations that could influence the need for additional studies.

The subcommittee will be composed of up to 10 members, 4 from the Scientific Committee and up to 6 from the Policy Committee, and will be co-chaired by a member from each Committee. The subcommittee will submit a report to the Director, MMS within 12 months of its formation.

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Acronyms

API	American Petroleum Institute
Bbbl	Billion barrels
bbl	Barrel
BOE	Barrels of oil equivalent
BRD	Biological Resources Division
CMI	Coastal Marine Institute
DOE	Department of Energy
DOI	Department of the Interior
EPA	Environmental Protection Agency
ESP	Environmental Studies Program
FY	Fiscal Year
GOM	Gulf of Mexico
Mcf	Thousand cubic feet
MMS	Minerals Management Service
NAS	National Academy of Sciences
NBS	National Biological Survey
NEPA	National Environmental Policy Act
NRC	National Research Council
OBPA	Outer Banks Protection Act
OCS	Outer Continental Shelf
OPA	Oil Pollution Act
Tcf	Trillion cubic feet
USGS	United States Geological Survey

Executive Summary

The Subcommittee on Environmental Information for Select OCS Areas Under Moratoria was jointly established by the Outer Continental Shelf (OCS) Policy and Scientific Committees of the Minerals Management Advisory Board in January 1996. The purpose of the subcommittee was to independently review, evaluate, and provide guidance on information needs for OCS areas where leasing is now prohibited (termed moratoria), but may be considered in the future. These moratoria areas, created through Congressional/Presidential action since 1982, are estimated by the Minerals Management Service (MMS) to contain significant quantities of undiscovered and conventionally recoverable oil and natural gas.

During its deliberations for assessing information needs and providing guidance on gathering information for decision purposes, the subcommittee considered the findings and recommendations of the National Research Council's (NRC) reports addressing the MMS' Environmental Studies Program (ESP) and other related OCS issues, as well as the MMS's response to those findings and recommendations. In addition, the subcommittee considered the following issues:

- the amount of undiscovered oil and natural gas resources and the physical form (natural gas versus oil) of petroleum resources estimated for moratoria areas;
- recent advances in technologies and procedures of the offshore petroleum industry;
- the environmental record of the offshore petroleum industry; and
- ESP budgetary constraints.

After careful review and consideration of these issues, the subcommittee makes the following findings and recommendations.

1. The MMS should proceed with environmental studies in moratoria areas.

The subcommittee neither endorses nor opposes opening moratoria areas for future leasing. The subcommittee does recognize, however, that future energy requirements may lead to the need to explore and produce oil and natural gas in these areas. Should this occur, the MMS must be prepared to predict, assess, and manage the impacts from oil and natural gas operations.

2. Congress should support environmental studies in moratoria areas with new funds.

Funding for the ESP has declined from a high of \$55.5 million in 1976 to \$14 million in 1996. Current funding is insufficient to provide for adequate study of both moratoria areas and those areas currently experiencing OCS exploration and production.

3. The MMS should request the funds necessary to initiate environmental studies in moratoria areas in its 1999 budget.

Because of the time requirements from study planning and initiation to publication of the scientific results, the subcommittee recommends that appropriate environmental studies for moratoria areas be started as soon as possible. These studies should be administered and directed by MMS because of the high level of direct interaction needed among MMS, stakeholders, and researchers.

4. The MMS should maintain, or have access to, up-to-date, basic information on oil and natural gas resources and natural resources within moratoria areas.

The MMS should use the most sophisticated technologies available to refine and update its assessment/inventory of oil and natural gas resources in all OCS planning areas. In addition, the MMS should also maintain or have access to basic knowledge of important natural and cultural resources and oceanographic features in all OCS planning areas.

5. The MMS should establish a social and economic studies program that includes current data for all

OCS areas, including moratoria areas.

As with natural resources, a basic level of social and economic data should be collected in all OCS planning areas and updated as needed. These data are especially important in moratoria areas to examine potential costs and benefits to affected communities. Workshops should be conducted in all OCS planning areas to assist in delineating regional and subregional research needs.

6. The MMS should maintain knowledge of key issues and of information needs in moratoria areas.

The MMS should maintain experts to assist in identifying and responding to national and regional specific issues. The MMS should consult with the members of the Minerals Management Service Advisory Board and university researchers to identify key scientific issues and information needs.

7. The subcommittee recommends that the MMS refine its generic process for identifying the studies required to be performed in moratoria areas to meet information needs and formulate a strategy for this process that includes affected States and other stakeholders, including industry. The MMS should be cognizant of all recent environmental studies, new technologies, and industry interest.

Due to a variety of factors, environmental study priorities may have changed in some planning areas since the NRC reviews. The MMS is encouraged to develop new strategies with the participation of all stakeholders, for inventorying information available and identifying and selecting environmental studies necessary for making leasing decisions.

8. The MMS should continue to be supportive of the development of new and advanced technologies that improve operational performance and reduce environmental risk.

Numerous technological advances that enhance and improve all facets of OCS operations have been made over the last several years. However, a concerted Federal-industry effort to improve technologies must continue in order to ensure that all OCS activities are performed in a manner that minimizes environmental risks and maximizes economic benefits.

9. Environmental studies should be tailored to the different environmental risks associated with the production of oil versus natural gas. The different environmental risks associated with the production of liquid oil versus natural gas should be considered when developing study needs for moratoria areas.

The principal difference in environmental risk associated with the exploration and production of oil versus natural gas is the danger of accidentally spilled oil compared to the release of volatile natural gas. Other environmental risks are similar for oil or natural gas production. Environmental studies and evaluations should recognize these differences.

10. The MMS should support and expand environmental studies in cooperation with other Federal and State agencies, universities, and industry.

Reduced ESP budgets, as well as the need to use monies in areas with active leasing, significantly limits the funding of studies in moratoria areas. Cooperation between Federal and State agencies, local universities, and industry will provide the MMS with the opportunity to leverage limited funds and better identify environmental conditions and issues of local concern. However, cooperative funding efforts should not limit the ESP funding or restrict study priorities.

Introduction

The purpose of this report is to provide guidance on information needs for current moratoria areas in coastal and offshore regions where Outer Continental Shelf (OCS) oil and natural gas leasing is now prohibited, but may be considered in the future. Since 1982, actions taken by Congress/the President have withdrawn large areas from leasing along the eastern and western seaboard, Alaska, and the eastern Gulf of Mexico. These withdrawals have been termed “moratoria.” The following OCS planning areas have been subjected to moratoria (fig. 1):

- North, Mid- and South Atlantic
- Eastern Gulf of Mexico
- Washington - Oregon
- North Aleutian Basin
- Southern, Central, and Northern California

The U.S. Department of the Interior (DOI), Minerals Management Service leases the Federal offshore seabed for oil and natural gas exploration, development, and production. The DOI also gathers and procures environmental information necessary for making decisions about the OCS through its Environmental Studies Program.

At the request of the DOI, the National Research Council (NRC) of the National Academy of Sciences reviewed the Environmental Studies Program and made a series of recommendations between 1989 and 1993. The report by the Subcommittee on Environmental Information for Select OCS Areas Under Moratoria specifically addresses OCS moratoria areas and recommends a process for obtaining the needed environmental information identified by the NRC.

Minerals Management Service Responsibility

The Minerals Management Service (MMS) is the bureau within the DOI with primary responsibilities to manage the mineral

INSERT FIGURE 1.. OCS PLANNING AREAS...

resources located on the Nation's OCS, to collect revenue from Federal OCS and onshore Federal and Indian lands, and to distribute those revenues. The Offshore Minerals Management Program administers the OCS competitive leasing program and oversees exploration, production, and development of the Nation's offshore oil, natural gas, and other mineral resources to ensure that activities occur in a safe and environmentally sound manner and that the Nation receives fair market value for these resources.

Policy and Scientific Committees' Responsibilities

The DOI established the Minerals Management Advisory Board to provide advice to the Secretary of the Interior concerning the performance of discretionary functions under the OCS Lands Act, as amended (43 U.S.C. 1331-1343), including environmentally sound leasing, exploration, development, and production of OCS mineral resources. The Board also has responsibility for royalty management issues.

The Minerals Management Advisory Board is composed of the following committees: OCS Policy Committee, OCS Scientific Committee, Alaska OCS Region Offshore Advisory Committee, and Royalty Policy Committee. The committees may establish subcommittees. Membership of subcommittees is intended to be balanced in terms of viewpoints, functions to be performed, and necessary expertise. Nonmembers of the parent committee may be included in subcommittees as necessary. Each subcommittee reports to its parent committee.

The OCS Policy Committee, established in 1975, provides policy advice representing the collective views of coastal States, environmental groups, industry and other constituencies affected by the OCS program. The OCS Scientific Committee, also established in 1975, advises the MMS on the feasibility, appropriateness, and scientific value of the Environmental Studies Program (ESP) and consists of scientists with expertise in marine science and social and economic disciplines.

The Subcommittee on Environmental Information for Select OCS Areas Under Moratoria, established in January 1996, is the first subcommittee jointly established by the OCS Policy and

Scientific Committees. Thus, this subcommittee's report has been approved by both parent committees before being submitted to the DOI.

Charge to the Subcommittee

In the fall of 1995, the MMS Director and chairs of the OCS Policy and Scientific Committees began discussing the need for environmental studies in areas under moratoria, which had been deferred when policies restricted studies only to areas with active leases. As a result of these discussions, the Director requested the assistance of the two committees, specifically asking that they take a long-term view to provide guidance on environmental information in current moratoria areas beyond the 5-year program¹ which ends in 2002.

Through its charter, the subcommittee was tasked to review specific information needs for areas where controversy has led to restrictions on leasing. It was also tasked to provide guidance on filling information gaps identified by past NRC reviews to help focus future ESP research. In assessing these information needs, the subcommittee was asked to review recent environmental information, budget constraints, current and future oil and natural gas technology, the OCS environmental record, and the likelihood of discovering oil or gas in the areas. Lastly, the subcommittee was asked to identify and evaluate alternative strategies that could influence the need for additional studies.

This report is intended to provide the MMS with practical guidance on gathering necessary environmental, social and economic, and oil and natural gas information for decision purposes should these areas be considered for future leasing.

History

Moratoria Background

Moratoria have been sought by coastal States and communities due to their concerns about the impacts of oil and natural gas development off their coasts. The potential for environmental damage and social disruption caused by both routine activities and accidents, such as oil spills, resulted in local pressure to prevent these possibilities by removing areas from the lease schedule. Communities and State governments pursued

moratoria when they believed that was the most effective mechanism to constrain OCS development within the current leasing system.

Federal management of the OCS began in 1953 with activity concentrated off Louisiana and Texas. Some exploration occurred in the late 1950's and early 1960's off Washington, Oregon, California, and Florida, but no commercial discoveries were made, except offshore southern California. The 1969 Santa Barbara Channel oil spill drew national attention and resulted in opposition to oil and natural gas development.

However, when the oil embargo of late 1973 and early 1974 brought high prices and waiting lines at gas stations, public opinion shifted toward meeting the Nation's energy needs through domestic production. The Federal Government responded by expanding the OCS program to include areas where leasing and development had not occurred before. The increased scope and pace of activity heightened concerns about the environmental and social and economic effects of offshore development. Citizens and State and local governments in coastal areas demanded that they be consulted before the Federal Government proceeded with its leasing and development plans. As a result, Congress extensively amended the OCS Lands Act in 1978 to provide for more environmental consideration and more substantive involvement of State and local governments and others in OCS decisions.

In 1979, the Iranian revolution and resulting oil supply disruptions and price increases renewed the sense of urgency for developing domestic offshore resources. The Federal Government responded by proposing to make available nearly 1 billion acres for potential leasing, the largest amount of OCS acreage ever offered. The plan included numerous sales in frontier areas off the Atlantic, Pacific, Alaska, and Florida coasts. This 1-billion-acre plan sparked immediate and widespread opposition. Even though the new provisions of the OCS Lands Act called for increased consultation and coordination, many affected parties believed that their concerns and recommendations were not being adequately considered in OCS decisions.

In 1982, Congress imposed the first moratoria on OCS activity by removing 736,000 acres off northern and central California

from leasing. Since that time, moratoria have been established in all or portions of every OCS region (fig. 2).

Both Congress and the President have the authority to impose moratoria. Congress can enact moratoria provisions by prohibiting the expenditure of funds for various OCS activities in the Interior appropriations bills or through authorizing legislation. Section 12 of the OCS Lands Act states that the “President of the United States may from time to time withdraw from disposition any unleased lands of the OCS.” A presidential withdrawal of unleased lands is a standing directive until reversed by the President.

In June 1990, President Bush announced a directive that withdrew from leasing, until after the year 2000, offshore areas of northern and central California, southern California (except for 87 tracts), southwest Florida, the North Atlantic Sale 96 Planning Area, and Washington/Oregon. In addition, the Outer Banks Protection Act (OBPA), an amendment to the Oil Pollution Act of 1990, prohibited leasing and drilling on existing leases located offshore North Carolina. The leasing ban remains off North Carolina, through appropriations language, but the drilling ban has been lifted with the repeal of the OBPA in 1996.

The Fiscal Year (FY) 1991 appropriations bill contained a moratoria provision that reaffirmed the 1990 Presidential policy statement. The 1990 directive was also reaffirmed in a 1992 directive from the President, clarifying the section 12 authority for the OCS Oil and Natural Gas Leasing Program 1997-2002 decision. In the 1992 directive, President Bush withdrew the previously exempted 87 tracts in the Southern California Planning Area until 1997 and pending completion of environmental studies. Congress has reinstated the same moratoria language each fiscal year since 1992. For FY 1997, Congress continued these moratoria.

To date, Congress has enacted several types of moratoria:

- ***preleasing*** - prohibits consultation and environmental analyses required under the OCS Lands Act, National

FIGURE 2...HISTORY OF CONGRESSIONAL MORATORIA.

Environmental Policy Act (NEPA), and other applicable laws;

- ***leasing*** - prohibits the lease sale but does not prohibit necessary prelease work leading up to the proposed sale;
- ***drilling*** - prohibits approval of any exploration or development/production plans associated with existing leases; and
- ***geological and geophysical surveys*** - prohibits certain types of geological investigations.

In no instance, however, did Congress put legal restrictions on performing environmental studies in these areas. However, in recent years Congress has encouraged MMS to concentrate its ESP efforts in areas with industry activity or proposed lease sales. For example, the FY 1995 Conference Report stated that “the environmental studies program will be weighted heavily toward the Gulf of Mexico region where the vast majority of OCS activity takes place.” Many House and Senate appropriations reports from recent years recommended that studies should focus on areas that have active leases or are under consideration for leasing in the current 5-year program. In addition, because of reduced ESP budgets and changes in program priorities, MMS has been limited in the studies it could plan and has therefore funded studies in areas with ongoing activity.

Administrative Exclusions for Leasing

The 5-year programs developed by MMS, which are reviewed by the Congress and the President, may also exclude certain planning areas from consideration for leasing. If an area is not initially included in the plan, then no lease sale can be held during that 5-year program and typically no preleasing activities or studies are conducted by MMS. Although not technically the same as moratoria or prohibitions placed on MMS through the congressional appropriations process, exclusion of an area from the 5-year program eliminates any leasing activity in that area for that period (fig. 3).

FIGURE 3...OCS PLANNING AREAS EXCLUDED FROM 5-YR

MMS Response to Moratoria

Over the past several years, MMS has focused efforts on reducing conflict regarding the OCS leasing program. Based on a recommendation from the subcommittee report, *Moving Beyond Conflict to Consensus*, approved by the OCS Policy Committee in 1993, MMS established the Alaska Regional Stakeholders Task Force to address local communities' concerns over pending lease sales. In the Santa Barbara, California, area, the Tri-County Forum was created to address concerns about development in the channel area.

The MMS has also negotiated settlements in areas of special concern—leases off south Florida and in Bristol Bay, Alaska (North Aleutian planning area). Furthermore, the 5-year program for 1997-2002 better reflects the views of constituents by proposing new leasing only in the Gulf of Mexico and off Alaska. Other areas where conflicts over active leases have not been resolved or where proposed leasing activities are still in litigation, such as North Carolina, were excluded from consideration in this program.

Resource Assessment

OCS Production and Resources

Oil and natural gas resources on the Federal OCS have been in production since the 1950's. Through 1995, 10.5 billion barrels of oil and 118 trillion cubic feet of natural gas have been produced from the OCS. Annual production for 1995 from the OCS totals 412 million barrels of oil or approximately 15 percent of our Nation's production, and 4.85 trillion cubic feet of natural gas or approximately 25 percent of our domestic production (OCS Reports MMS 96-0060 and 96-0061). The MMS estimates that 45.6 billion barrels of undiscovered conventionally recoverable oil resources and 268 trillion cubic feet of undiscovered conventionally recoverable natural gas resources remain on the Federal OCS (MMS, 1996).

The United States depends on oil and natural gas for 63 percent of its energy consumption (DOE, 1996). Presently, the Nation imports over 50 percent of the oil supplies required to meet the Nation's energy demands (Geotimes, 1996). In response to the increased level of imported oil, the Department of Energy (DOE) issued a *Domestic Natural Gas and Oil Initiative*. The

Secretary of Energy emphasized the importance of this initiative by stating that “the end goal of this project will be to develop new and expanded opportunities for jobs in the domestic gas and oil industries, while fostering a climate which will increase production from the domestic resource bases and reduce our reliance on foreign oil.” Natural gas is an increasingly important component of the Nation’s energy supplies (DOE, 1996). It is now recognized as the fuel of choice because it is clean burning and domestically abundant.

New production of oil and natural gas on the Federal OCS is being used to help offset declining onshore production (DOE, 1996). With such continued declines, the oil and natural gas resources on the Federal OCS become increasingly important to the energy security of the United States.

Potential of Moratoria Areas

A substantial amount of oil and natural gas may exist in OCS areas currently subject to moratoria (table 1). The MMS estimates that 15.2 billion barrels of oil or 33 percent of the total mean estimate of the undiscovered, conventionally recoverable oil resources of the OCS may exist in these areas. Of this total, 6.8 billion barrels of oil may be economically recoverable under price and cost relationships of \$18/barrel (bbl) for oil. This total represents 47 percent of the total undiscovered economically recoverable oil resources for the entire OCS. Similarly, MMS estimates that 61.5 trillion cubic feet (Tcf) of natural gas or 23 percent of the undiscovered conventionally recoverable natural gas resources of the OCS may exist in the areas subject to moratoria. Of this total, 19 Tcf of natural gas may be economically recoverable under current price and cost relationships of \$2.11/thousand cubic feet (Mcf). This total represents 26 percent of the total undiscovered economically recoverable natural gas resources for the entire OCS. These resource estimates are based on the 1995 assessment of the undiscovered oil and natural gas resources on the OCS (MMS, 1996). (See appendix A for supporting information on this assessment.)

Of the moratoria areas, the southern California area has the highest potential for oil and natural gas. The northern and

TABLE 1. UNDISCOVERED RESOURCES

Environmental Studies Program

central California and southeastern Gulf of Mexico areas also have considerable oil potential. The northern, middle, and southern Atlantic, the eastern Gulf of Mexico (offshore Northwest Florida and Alabama), and the north Aleutian Basin have high potential for natural gas. Northern and central California and Washington-Oregon also have certain areas that have natural gas potential. An area is considered to be gas-prone if scientific judgment indicates that any successful exploratory wells drilled will most likely encounter natural gas rather than oil. This judgment is based on the geologic and thermal histories of the area and on information gained from any wells drilled. However, the discovery of oil is not precluded in these gas-prone areas. Ultimately, exploratory drilling is the only means to determine if the resource exists and whether it is oil or natural gas.

The subcommittee discussed whether it was practical to determine industry interest in areas currently under moratoria, but concluded this could not be done meaningfully. Industry was last “officially polled” in 1989 during the preparation of the MMS 5-Year Program for 1992-1997. This industry response may not represent current interest. Drilling successes and failures since 1989 and the public opposition industry would face in the moratoria areas could influence current interest.

The ESP within MMS gathers and procures environmental and social and economic information needed for OCS decisions. The ESP was initiated in 1973 with a budget of \$370,000 to support the DOI's OCS oil and natural gas leasing program. Statutory authority is derived primarily from three laws: the 1953 OCS Lands Act, the 1969 National Environmental Policy Act, and the OCS Lands Act Amendments of 1978.

As mandated by Congress under the OCS Lands Act Amendments of 1978, the role of the ESP is to provide information needed for assessing and managing potential impacts on the human, marine, and coastal environments of the OCS and the coastal areas that may be affected by oil and natural gas development. To meet this mandate, the MMS conducts a wide array of studies under eight broadly defined scientific categories: air quality, biology/ecology, fates and effects, fisheries, geology, physical oceanography, protected and endangered species, and social and economics. Most

studies are performed by universities, State and other Federal agencies, and private consultants.

Funding for the ESP

Total funding for the ESP from FY 1973 through FY 1996 has been approximately \$620 million, which was used to fund over 1,300 individual projects and studies. As figure 4 shows, the highest level of ESP funding was FY 1976 when the budget exceeded \$55.5 million. Funding has been reduced in most years since that time. The FY 1996 appropriated budget for the ESP was about \$12.8 million plus \$1.2 million provided under the Oil Pollution Act of 1990.

In FY 1994, the National Biological Service (NBS) was formed in the Department of the Interior to perform biological research for all DOI bureaus. With this action, \$5 million was transferred from the MMS ESP base funding to the NBS, of which \$4.5 million was to annually fund MMS biological studies.

Due to budget reductions, NBS reduced the MMS-designated funds to \$2.7 million in FY 1996. In FY 1997, the NBS became the Biological Resources Division (BRD) of the U.S. Geological Survey (USGS). Because of the reduced budget, USGS/BRD could not begin new studies for MMS in FY 1997, but could only continue those already started. Since the creation of the NBS, the OCS Scientific Committee has expressed concern over the NBS/BRD reduction in funding MMS studies and continued to support MMS managing its research funds, even for biological studies.

In recent years, MMS has funded few studies in areas under moratoria. Based on an NRC recommendation, MMS decided to focus studies on areas with ongoing industry activity, such as the Gulf of Mexico. In recent appropriations reports, Congress also encouraged MMS to focus on areas with active leases or under current consideration for leasing.

As a result of the budget constraints of the past few years,

FIGURE 4. STUDIES FUNDING.

MMS has had to find ways to leverage its limited budget for the ESP. The MMS has accomplished this in two basic ways. One is through interagency agreements with other Federal agencies (e.g., Department of Energy, Office of Naval Research, National Marine Fisheries Service) to cofund research of mutual interest and application to mission needs. Within DOI, the MMS works closely with USGS/BRD, the Fish and Wildlife Service, and the National Park Service. The second vehicle is MMS's formation of the Coastal Marine Institutes (CMI's) with Louisiana State University, the University of Alaska at Fairbanks, and the University of California at Santa Barbara. Under the terms of the CMI's, MMS and the States, through the respective universities, solicit, review, and equally cofund OCS-related research of mutual interest. These Federal-State partnerships, the first of which was initiated in 1992, not only address issues of mutual interest through shared funding but expand the traditional pool of regional scientists who participate in the ESP.

NRC Reviews

In its early years, 1973-1978, the ESP supported mostly baseline studies designed to characterize the biological, chemical, geological, and physical environments. However, reviews of the ESP in 1977-1978 by the General Accounting Office and the NRC criticized the baseline studies approach because natural variability made it impossible to establish statistically valid characterization over large geographic areas. Thus, beginning in 1979, the ESP shifted focus to tie studies more closely to management decisions and to provide information needed to support the lease sale process. Beginning in the mid-1980's, the program evolved further to specifically include studies that would provide information needed for postlease, operational decisions. These postlease studies included multiyear fates and effects monitoring studies of operational platforms, OCS air quality studies, and field and modeling efforts to better understand water circulation and to predict the movement of spilled oil.

In 1986, the MMS asked the NRC to review the MMS's ESP and to make recommendations for the future focus of the program. The NRC formed the Committee to Review the Outer Continental Shelf Environmental Studies Program under

its Board on Environmental Studies and Toxicology. The Committee formed three panels to review and offer recommendations in each of three broad scientific disciplines: ecology, physical oceanography, and social and economic studies. In addition, the NRC was to review the overall program and publish its findings in a fourth summary volume. After the NRC formed the three panels in 1988, the MMS requested an additional study of the adequacy of environmental information for OCS oil and natural gas decisions for Georges Bank in the North Atlantic Planning Area. In the spring of 1989, the Committee was asked by the President's cabinet-level Task Force on OCS Leasing and Development to review the adequacy of scientific and technical information of environmental impacts for three lease sales off southwestern Florida, southern California, and northern California. Finally, language in the House 1991 appropriations report recommended that MMS ask the NRC to review environmental information for leasing decisions for planned sales in the Chukchi Sea, Beaufort Sea, and Navarin Basin off Alaska.

Based on these reviews, the NRC completed the reports listed below.

Sale Related

- *The Adequacy of Environmental Information for Outer Continental Shelf Oil and Gas Decisions: Florida and California, 1989*
- *The Adequacy of Environmental Information for Outer Continental Shelf Oil and Gas Decisions: Georges Bank, 1991*
- *Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska, 1994*

ESP Related

- *Assessment of the U.S. Outer Continental Shelf Environmental Studies Program: I. Physical Oceanography, 1990*
- *Assessment of the U.S. Outer Continental Shelf Environmental Studies Program: II. Ecology, 1992*
- *Assessment of the U.S. Outer Continental Shelf*

Environmental Studies Program: III. Social and Economic Studies, 1992

- *Assessment of the U.S. Outer Continental Shelf Environmental Studies Program: IV. Lessons and Opportunities*, 1993

In addition, the NRC completed several other reports that were related to OCS issues.

Offshore Oil and Natural Gas Related

- *Drilling Discharges in the Marine Environment*, 1983
- *Oil in the Sea—Inputs, Fates, and Effects*, 1985
- *Our Seabed Frontier—Challenges and Choices*, 1989
- *Undiscovered Oil and Gas Resources—An Evaluation of the Department of the Interior's 1989 Assessment Procedures*, 1991
- *Oceanography in the Next Decade—Building New Partnerships*, 1992
- *Science, Policy, and the Coast—Improved Decision Making*, 1995
- *Improving Interactions Between Coastal Science and Policy*, Proceedings of the Gulf of Mexico Symposium, 1996
- *An Assessment of Techniques for Removing Offshore Structures*, 1996

The NRC's overall conclusions and recommendations are contained in its 1993 *Assessment of the U.S. Outer Continental Shelf Environmental Studies Program: IV Lessons and Opportunities* report. The following is a brief summary of the report and MMS response. (Appendix B includes a detailed summary of the major recommendations made by the NRC in this report and a summary of MMS's response.)

The NRC commended the ESP for contributing significantly to

the knowledge about the continental shelf areas of the United States, for its cooperative efforts with other Federal agencies and industry, its CMI-type relationships with universities (especially for recognizing the importance of postlease studies and increased academic involvement), and for its Alaskan social and economics program. The NRC recommended several new goals for the ESP, including:

- continued management support for the ESP and follow through on the previous report's recommendations,
- improving its conceptual framework to better balance scientific studies from one region to another,
- strengthening the role of the Scientific Committee,
- increasing the focus on monitoring the effects of OCS activities and including studies on nearshore and onland effects,
- improving the social and economics program in areas outside Alaska,
- integrating modeling and field observation programs,
- expanding its relationships with universities and continuing partnerships with other agencies.

The MMS has been implementing these changes recommended by the NRC. The MMS has taken a more active role in ensuring that ESP studies are closely linked to the information needed for OCS decisions. Because of the reduced budget and new program responsibilities such as the increase in sand and gravel projects, MMS has been forced to place priority on studies linked closely to areas with ongoing or upcoming sales or industry activity. Therefore, studies in moratoria areas cannot be conducted without new funding.

The MMS has strengthened the role of the OCS Scientific Committee. The MMS Director regularly meets with the leadership of the Scientific Committee and ensures they are involved in program planning. The MMS has been seeking the Committee's advice on MMS's study strategy for planning

areas and on future issues identified by the Scientific Committee. Members are invited to participate in the design and review of key studies.

The MMS has also expanded its relationships with State universities. The NRC commended MMS for its University Initiative program, and MMS has expanded this program by developing special research relationships—the Coastal Marine Institutes—with university systems in Louisiana, California, and Alaska, all areas with ongoing OCS activity. The Scientific Committee participates in the oversight of the CMI's. In addition to CMI's, MMS also uses State researchers on other relevant projects. Likewise, the NRC commended MMS for its active partnerships with other Federal agencies. The MMS continues relationships, such as with the USGS (including its Biological Research Division), the Fish and Wildlife Service, the National Park Service, various offices in National Oceanographic and Atmospheric Administration (National Ocean Service, National Marine Fisheries Service, National Data Buoy Center), the Office of Naval Research, the Environmental Protection Agency (EPA), the Department of Energy, and the Corps of Engineers.

In recent years, MMS addressed the NRC concerns regarding monitoring the effects of oil and natural gas activity in areas with ongoing industry activity. The MMS gave higher priority to studies in the Gulf of Mexico, with major efforts in oceanography, platform monitoring, marine mammals, and social and economic studies. Similar studies were done in the Santa Barbara Channel area, which is an area of production off California.

Since the NRC reviews, physical oceanography field programs have occurred in the Gulf of Mexico, the Santa Barbara Channel, and off North Carolina. As recommended by the NRC, the field observations studies were coordinated with the ocean circulation modeling efforts, and MMS has made better use of surface drifters to track ocean currents. The Scientific Committee has assisted MMS staff in ensuring that this integration of the modeling and field observation programs has been successful.

The MMS instituted long-term platform monitoring in both the

Pacific and Gulf of Mexico, as recommended by the NRC. Examples include the California Monitoring Program (CAMP) to understand the stability of sediments and drilling muds and the Gulf of Mexico Offshore Operations Monitoring Experiment (GOOMEX) to understand the low-level, chronic stresses in areas with long-term production. Monitoring continues around the Flower Garden Banks Marine Sanctuary in the Gulf of Mexico. An increased number of marine mammal and turtle surveys have been done in the Gulf of Mexico in areas with ongoing industry activity. Studies continue on areas of special habitat, such as the chemosynthetic² and pinnacle trend communities³ in the Gulf of Mexico. To address nearshore and onshore issues, MMS has sponsored studies on wetlands and on bird and marine mammal onshore habitats.

The MMS expanded its social and economic studies in recent years. The NRC commended the MMS Social and Economic Program in Alaska, but recommended that MMS improve its program in other areas. As part of the process to strengthen its social and economics program, MMS has been working with its Scientific Committee to develop a programmatic framework. The MMS also held workshops with stakeholders in California and the Gulf of Mexico States to define social and economic issues and to develop plans to address them. The workshops led to a series of studies in the Gulf of Mexico States and California. One major study is the California Offshore Oil and Gas Energy Resources (COOGER) project. This cooperative effort with the counties in the Santa Barbara Channel area will provide an overview of the development that could possibly result from undeveloped existing leases in the area.

Other Reviews of Environmental Information

The Oil Pollution Act of 1990, in a section cited as the Outer Banks Protection Act, established the North Carolina Environmental Sciences Review Panel to assess the adequacy of the available physical oceanographic, ecological, and social and economic information for oil and natural gas activities offshore of North Carolina. They summarized their findings in the 1992 *Report to the Secretary of the Interior from the North Carolina Environmental Sciences Review Panel as Mandated by the Oil Pollution Act of 1990*.

Environmental Considerations Related to the OCS Program

The Pacific OCS Northwest Task Force was established by the Secretary of the Interior in 1989, and recommended environmental research needed before leasing in the Washington—Oregon Planning Area. The Task Force was disbanded with the decision of the President in June 1990 to establish a moratoria on leasing in the area until the year 2000 and until environmental studies could be completed.

Effects on the Human, Marine, and Coastal Environments from the OCS Program

Exploration, development, and production of oil and natural gas can impact the marine and coastal environments. Impacts can occur from routine activities or from accidents. Routine permitted activities can contribute to chronic effects on the marine ecology and social or economic conditions onshore. Such activities include the discharge of liquids and solids—including drilling muds—into the ocean; emission of gases into the air; tanker, service vessel, and helicopter operations; and construction, operation, and removal of facilities both offshore and onshore. Accidents such as oil spills may have acute effects. This latter category generally is viewed as much more threatening to the environment due to the damage and disruption a large spill could cause to ecological resources and to coastal livelihoods and activities that depend on those resources.

However, many potential effects are avoided because of preventive measures instituted by industry and the regulatory agencies. As noted in the Technology section of this report, standard industry practice reduces the likelihood of adverse effects. Likewise, MMS and other regulatory agencies, such as EPA, the National Marine Fisheries Service (NMFS), and others have revised regulations to better address pollution prevention and safety.

Routine Activities

The activities and events associated with OCS oil and natural gas operations can potentially result in ecological and social and economic impacts. Regulations and operating conditions established by MMS, EPA, NMFS and others attempt to minimize the following: water and air quality impacts; effects to

marine and avian wildlife; routine effects to shorelines, wetlands and estuaries, wildlife habitats, and on coastal communities (e.g., changes in land use patterns, greater employment demands, higher population, and increased need for government services); effects on tourism and recreation (e.g., diminished aesthetics); conflict with commercial and recreational fishing interests (preemption or closure of fishing grounds and damage or loss of equipment); disturbance of historic or prehistoric archaeological resources; and interference with the cultural and subsistence activities.

Accidents

Oil may enter the marine environment in several ways. A 1985 NRC study estimated that worldwide offshore oil and natural gas development was responsible for less than 2 percent of oil entering the sea. Marine transportation accounted for 46 percent and runoff from cities and industry 37 percent. Natural seepage also contributes oil. Seeps are found where oil or natural gas-bearing strata intersect the earth's surface, or where they are tapped by faults and fractures. Seeps are common in both the Gulf of Mexico and offshore southern California, with an estimated 1,000 barrels seeping naturally each day into U.S. coastal waters.

While large accidental oil spills have occurred as a result of OCS operations, there have not been many. Following the most notorious event resulting from operations on the Federal OCS, the 1969 Santa Barbara blowout, improvements in government regulation, industry practices and technology were implemented. Those reforms have resulted in OCS operations that have been relatively free of large accidental oil spills.

According to records maintained by the MMS from 1980 through 1995, there have been seven spills ($\geq 1,000$ barrels) from OCS operations (see table 2). These seven spills constituted less than 1 percent of OCS spill occurrences during that period, even though they accounted for approximately 77 percent of the spillage. Even with Hurricane Andrew in 1992, an extremely strong storm that impacted over 2,000 Gulf of Mexico oil platforms, the 2,500 barrels of oil spilled all came from damaged pipelines. Since 1980, OCS operators have produced more than 5.5 billion barrels of oil, while the amount

of oil spilled totaled approximately 61,000 barrels (0.001 percent), or 1 barrel spilled for every 90,000 barrels produced. It is notable that no claims have ever been made against funds that have been maintained to provide compensation for oil spills resulting from OCS operations since enactment of the OCS Lands Act Amendments of 1978.

Although both oil and natural gas are produced from the OCS, more natural gas is produced than oil. About 75 percent of OCS energy production is natural gas, which poses less risk of pollution. Natural gas is clean burning and a relatively abundant domestic fossil fuel. The development and production of natural gas are unlikely to result in oil spills. Natural gas is volatile, and incidents on the OCS generally have resulted only in the release of gas into the atmosphere. To date, this loss of natural gas has caused no discernible adverse effects.

OCS Operations versus Tanker Operations

Table 2 lists crude oil spills of 1,000 barrels or greater resulting from OCS operations versus 1,000 barrels or greater that have resulted from tanker operations in U.S. coastal and offshore waters from 1980.

Between 1980 and 1994, OCS spills ($\geq 1,000$ barrels from production and transportation) were responsible for about 11,000 barrels of oil being spilled for every billion barrels delivered. Tanker spills ($\geq 1,000$ barrels) resulted in about 13,000 barrels of crude oil being spilled into U.S. waters for every billion barrels delivered. However as noted in the table, tanker spills tend to be larger events than those from OCS pipelines, and the majority of tanker spills occurs in port or near shore where the potential environmental impact is more severe.

One factor that diminishes the likelihood of OCS blowouts and oil spills in volumes comparable to tanker spills such as the *Exxon Valdez* incident is the nature of most OCS oil reservoirs.

TABLE 2.. VOLUME OF SPILLS.

Oil is currently produced in the Gulf of Mexico and Pacific OCS Regions. Approximately 90 percent of the producing wells in the Pacific Region and 35 percent of the wells in the Gulf of Mexico lack sufficient formation pressure for oil to flow naturally to the surface. These require either pumping action or gas lift operations to remove the oil and thus pose only minimal risks of blowouts. The remainder, free flowing wells are predominately low flow (averaging approximately 250 barrels per day). Based on past experience, these low volume wells bridge over (i.e., fill in with sand and shale), thus naturally stopping flow after a few days following a blowout. New, higher volume wells in deeper water have the potential for larger spills and their tendency to naturally stop flowing in a blowout is uncertain because fewer numbers have been drilled to date.

Many oil wells in the deepwater fields have much higher production rates and, consequently, have greater potential for large spills. Many of these deepwater areas are included in areas under moratoria. Industry has made many deepwater discoveries over the past 10 years, most of which are located in the Central Gulf of Mexico Planning Area 20 or more miles offshore (away from sensitive coastal resources). The MMS has identified 50 deepwater fields that have leases designated as capable of producing in paying quantities. Several fixed platform deepwater wells with production rates up to 1,700 barrels per day are located approximately 20 miles southeast of the Mississippi Delta. Recently, wells have been developed with production flow rates in excess of 13,000 barrels per day. All of these are associated with the newest facilities located in the Gulf of Mexico 40 miles or more offshore. In 1995, leases from deepwater fields accounted for 14 percent of the oil production from OCS Gulf of Mexico leases, up from 4 percent in 1990. This percentage is expected to increase in the next 10 years. For every new and modified oil and natural gas development facility in the OCS Gulf of Mexico operators must submit detailed development plans to the MMS. The MMS and affected States closely scrutinize these plans for use of the latest and best available technologies. When development/production commences, the MMS conducts inspections of the facility. In the case of a floating facility, the U.S. Coast Guard conducts regular safety and environmental inspections. Recent modifications to the National Oil Spill Response Plan that

require operators to address response and clean-up for a “worst case” spill. This has resulted in the petroleum industry placing oil spill response equipment at critical sites along the Gulf coast, far surpassing what was available five years ago.

Over 98 percent of the production from the OCS is transported by pipeline. While the overall spill record of OCS operations is far better than the record for tanker operations, concerns have grown in recent years about the aging pipeline system in the Gulf of Mexico. Existing pipelines are generally of sufficient capacity to deliver only existing production. New OCS Gulf of Mexico facilities, especially those with large well capacities, necessitate the installation of new pipelines to deliver the newly produced oil and natural gas. These new pipelines must meet the most current MMS requirements for construction and testing, assuring an improved pipeline delivery system associated with new production.

Since 1992, there have been several changes to the pipeline safety laws to increase environmental protection and safety. The Pipeline Safety Act of 1992 (P.L. 102.-508) amended the Natural Gas Pipeline Safety Act of 1968 and the Hazardous Liquid Pipeline Safety Act of 1979 to provide for increased training, inspection, and reporting requirements. A major feature was the requirement that all new offshore pipelines 10 inches or greater in diameter be constructed to accommodate the passage of an instrumented internal inspection device (commonly referred to as “a smart pig”) to detect corrosion and other weaknesses in the line. The Act also provided for periodic inspection surveys for pipelines in the Gulf of Mexico lying in waters less than 15 feet deep to ensure that the lines are adequately buried so as not to pose a hazard to navigation or fishing. In October 1996, the pipeline safety acts were again amended to provide for 10 pipeline demonstration projects to test new risk management regulatory philosophies that would allow pipeline operators more flexibility in reaching environmental and safety goals. At this time, it has not been determined whether any offshore pipelines will be included in the 10 demonstration projects.

In December 1996, the Departments of the Interior (DOI) and Transportation (DOT) signed a new Memorandum of Understanding (MOU) on OCS Pipelines to replace the MOU

that has been in effect since 1976. Under the new MOU, about half of the OCS pipelines currently subject to DOT regulations will become subject to similar DOI requirements. Also, DOI will act as agent for DOT in inspecting for potential violations of DOT regulations for DOT-regulated pipelines and DOT-regulated pumping and compressor platforms on the OCS. The DOI and DOT will propose changes to their respective regulations to reflect the new regulatory boundaries and to put the new MOU into effect.

Technology

While the overall environmental record of OCS operations has been good, the offshore industry recognized that in the aftermath of the *Exxon Valdez* oil spill in 1989 there was a compelling need for improved management in all phases of oil and natural gas activity in the Nation's coastal waters. In response to that oil spill and other major spills that followed, the Congress in 1990 enacted the Oil Pollution Act (OPA) to consolidate and strengthen pollution prevention requirements applying to petroleum producers, transporters, and handlers both onshore and offshore.

The offshore industry promoted safety and pollution prevention both on their own initiative and to comply with the OPA and other laws and has developed technologies that enhance and improve all facets of their offshore operations. Many of these technological advances are the result of the natural evolution of engineering expertise. Others result from specific strategies to improve performance, reduce risk, lower operating cost, minimize long-term environmental effects, and mitigate environmental impacts.

The focus of this section is the technological advances in the offshore oil and natural gas industry that have helped reduce environmental impact and risk for all OCS areas.

Since lease moratoria began, many of the risk factors that influenced leasing and moratoria decisions have been reduced due to these technological advances. The following discussion, although unable to quantify changes in risk, highlights many of the operational, procedural, and level of service changes that have occurred during the past 6 years.

Recent Measures to Improve Safety and Pollution Prevention in OCS Operations

Based on guidance provided by the MMS Inspection Task Force and the National Academy of Sciences Marine Board, the MMS has supported the development of a structured and comprehensive nonregulatory method for reducing the risk and occurrence of accidents, injuries, and oil spills in the OCS. The American Petroleum Institute (API) formulated a voluntary standard—Recommended Practices for Development of a Safety and Environmental Management Program for OCS Operations and Facilities (RP 75)—with input from MMS. The RP 75 recommends that each OCS operator develop a safety and environmental management program (SEMP) to govern design, construction, operation, inspection, and maintenance of drilling and production facilities and guides operators in developing such a program.

Since RP 75 was published in May 1993, the API and the Offshore Operators Committee have conducted workshops to promote its voluntary implementation. The MMS has informed the API and the Committee that RP 75 provides a good foundation for promoting safety and environmental protection. Further, the MMS is working with those two organizations in monitoring and assessing the offshore industry's success in implementing RP 75 in order to determine whether SEMP should be pursued as a regulatory requirement.

In September 1993, API issued another Recommended Practice (RP 14J), which assembles into one document useful procedures and guidelines for planning, designing, and arranging offshore production facilities and for analyzing hazards on open-type offshore production facilities.

The MMS also funds a Technology Assessment and Research Program that focuses on safety and pollution prevention. Major recent and ongoing initiatives include deepwater technology evaluation, evaluation of aging infrastructure, pipeline leak detection, and research into human and organizational factors (80-90 percent of offshore accidents are attributed to human error).

Drilling

Drilling Fluids and Discharges

Drilling fluids are a crucial part of safe, efficient drilling, whether onshore or offshore. Over the past two decades, a broad variety of environmental studies have been conducted on the fate and effects of drill muds and cuttings in the environment. Much of this information was presented in the 1983 National Research Council report on *Drilling Discharges in the Marine Environment*. In combination with the scientific data gathered through these environmental studies, and the progression of environmental regulations (both the EPA's National Pollution Discharge Elimination System (NPDES) permit process and the MMS "biological stipulations"), the composition of drilling fluids, discharge methods, and the discharge requirements have changed to reduce environmental impacts.

As a result of the EPA Region VI "General Permit" and the supporting Offshore Effluent Guidelines, drilling fluids are less toxic. These same restrictions have evolved to an EPA-established toxicity limit, a ban on adding diesel fuel and other "oil" lubricants, a regulatory "bucket sheen test" to check for free oil, a mercury and cadmium limit (1 and 3 mg/l respectively) on barite, and discharge rate limitations. Also, new additives have been developed to increase drilling performance, lower operating costs, and reduce toxicity. Many of the newer (biodegradable), more expensive drilling fluids are being returned to shore for reprocessing and reuse. All these improvements have resulted in less environmental effect on OCS areas.

New technology currently being tested will also reduce the volume and effects of fluids and cuttings transport and disposal. One is the conversion of fluids and cuttings into cement for reinjection downhole. Another uses a vacuum thermal process to "strip" oil from cuttings to meet EPA acceptable discharge levels, eventually allowing discharge or recycling of the fluids.

Workover, Completion, and Treatment Fluids

A new technology, "Crudesorb Filtration," for treatment of workover, completion, and treatment fluids is proving successful in meeting the new EPA guideline limits for oil and

grease of 29 mg/l. Using the “bucket sheen” test has also proven to be more restrictive than the previous regulation of “no free oil” on the receiving waters. These have resulted in less oil being released to the ocean.

Drilling Rigs

In some environmentally sensitive areas, drilling rigs have been designed, or retrofitted, to be “zero discharge.” This can involve no discharge of drill muds and cuttings, or the installation of drip pans, scuppers, and a variety of other structural features to capture all runoff and spilled materials on the platforms. All such materials are temporarily stored on the rig and then transported back to shore for disposal.

Some of the new deepwater jackup rigs affect less sea bottom than floating rigs because of the absence of widespread mooring systems. Similarly, new deepwater tension leg platforms also impact less sea bottom than platforms previously used.

Drilling Technology

New electronic monitoring systems provide better control over drilling fluids and downhole pressures, thus providing safe control of the well. An increasing number of offshore development platforms are multiwell structures. With continual improvements in extended reach (most recent record is 16,410 feet) and horizontal drilling (over 1,500 feet horizontally in a producing zone), distant parts of the same hydrocarbon-producing structure can be reached from a single location. Use of these new technologies can increase oil and natural gas recovery from a single well and reduce the number of surface platform structures required to develop a particular reservoir, thus reducing the level of environmental risk.

The improved methods of “Measure While Drilling” and “Logging While Drilling” allow the driller to detect changes in downhole formations while drilling. Such methods reduce the time spent drilling wells, provide more accurate knowledge of reservoir pressures (thus minimizing the possibility of blowouts), and reduce the time required for making drill/no drill decisions. With these techniques, a decision to complete or plug and abandon a well can be made during drilling, reducing

the platform time on location and associated environmental concerns such as discharges and blowouts.

New multiplex blowout preventer (BOP) systems help to reduce the response time for shutdown, thus reducing the possibility of a blowout. Downhole, new dual metal-to-metal seal casing and tubing connections are being used to further reduce the chance of a leak. From floating drill vessels, initial drilling is done from free hanging marine riser systems connected from the vessel to BOP's located on the seafloor. New methods have been developed that allow immediate disconnect in the event of an emergency.

Top drive units greatly decrease the time spent on location due to their ability to rotate the drill string and circulate drilling mud while pulling pipe from the hole. This helps to reduce the risk of stuck pipe incidents, discharge volumes of cooling waters, mud, deck drainage, etc. per well. Additionally, the improved ability to secure the well when experiencing downhole over pressure situations minimizes the possibility of the uncontrolled influx of oil and natural gas into the well bore and back to the surface. This reduces the accidental release of drilling muds, oil, and natural gas to the environment and adds to the safety of the personnel working on the drilling rig.

New reduced or no lead pipe thread compounds are being used throughout the industry. Industry is also using new equipment to wipe drilling fluids from the drill string as it is withdrawn from the hole and placed in the pipe racks. This reduces mud loss to the environment.

Seismic Data

Recent advances in seismic data (geophysical) gathering and interpretation have increased drilling success percentages and have lead to fewer wells being drilled. Additionally, the improvements in shallow seismic survey equipment and techniques have enhanced abilities to detect shallow gas formations and to avoid potential shallow gas blowouts. Detailed sidescan sonar techniques are also being used to detect bottom topographical features that might pose undue risk to structures and pipelines. These same techniques are currently being used to pre-survey deepwater slope environments to

determine whether or not sensitive environmental communities such as the slope chemosynthetic communities might be present.

Improved seismic data collection methods (lower power charges, seasonal restrictions, fishing gear avoidance) have reduced the potential impact on marine life.

Oceanographic and Meteorological Forecasting

Improvements in satellite weather coverage, remote sensing, and weather modeling have greatly improved long-range weather forecasting. This allows the industry to be better prepared for severe weather events, including adequate lead time for shutdown operations and personnel evacuation when needed.

Similarly, improved oceanographic data, including remote sensing and in situ instrumentation, have allowed industry to improve engineering designs and, in the case of deepwater drilling, be better prepared for abnormal events such as the higher currents associated with Gulf of Mexico loop currents and warm core rings.

Producing

Produced Water

The highest volume discharge from offshore operations is produced water, which is typically a high salinity (~ 100 parts per thousand) brine that is coproduced with the oil, gas, or condensate. Produced waters contain a variety of downhole constituents (e.g., organics, inorganics, trace metals, and radionuclides), and their separation and treatment, and sometimes disposal, can be costly. Industry has continually improved the efficiency of the production separation process. Regulatory requirements have caused improvements in handling and treating produced waters that have reduced the environmental risk of discharging this waste stream. These developments have included toxicity limits on produced water, a reduction in the oil and grease limit to 29 mg/l, and a discharge flow rate limitation that is linked to water depth and the No Observable Effects Concentration. Discharge rates are limited to a maximum of 25,000 barrels per day (bpd) for any

single outfall within a 100-meter mixing zone. This minimizes the potential for impact on marine organisms within the initial mixing zone.

New technologies are being developed for removing oil and grease material from produced water. Industry is developing new chemicals that improve separation and reduce overall toxicity. Ozonation and membrane filtration methods are also being developed and tested.

Platforms

Improved designs and materials have allowed for smaller platforms (hence smaller seafloor footprint). As previously discussed, fewer platforms may be needed because of multi-well designs and new horizontal drilling technologies. Also, platform removal impacts have decreased due to improved techniques, observation programs, and strengthened regulatory requirements, thus effects to marine turtles and mammals have been reduced.

Facilities and Communications .

New and better communications, from cellular telephones to satellite transmission, have improved the safety and the response time in emergencies offshore. Almost the entire Gulf of Mexico offshore is now connected via an offshore cellular telephone network.

The advent of powerful laptop computers has moved much of the computing and analytical capabilities directly into the field. Engineering staffs can better monitor operating systems, perform on-site fatigue analysis, and calculate pipe lay stresses.

Many offshore structures are unmanned. The combination of onsite computer monitoring and improved communications allows for real-time monitoring of process control, well control, and fire detection from remote locations.

Oil-Spill Cleanup and Response

Since the *Exxon Valdez* spill and the Oil Pollution Act of 1990 (OPA 90), significant advances have been made in the ability to

respond to and clean up oil spills. Advances in remote sensing provide better detection and tracking of spills from the air. New dispersants more effectively disperse oil at sea. In addition, most OCS areas are now part of Regional Response Team preapproved dispersant application zones allowing for oil-spill responders to react fast enough to combat oil spilled at sea. This capability can significantly reduce the potential environmental impacts of oil spills, both at sea and along the shoreline.

Oil-spill trajectory and dispersion models are becoming more accurate. They now include information on natural resources at risk and assist decisionmakers in setting priorities to maximize cleanup and minimize environmental impact. New detailed environmental sensitivity area maps have been created for most coastal areas of the United States. These, in conjunction with new Area Contingency Plans required under OPA 90, have greatly increased the ability to respond to spills and reduce environmental risk.

Another result of OPA 90 was the creation of large, well equipped spill-response organizations such as the National Response Corporation and the Marine Spill Response Corporation. These organizations have ships deployed around the United States, stockpiles of equipment, and trained personnel on standby for spill response. Use of dedicated response boats in the Gulf of Mexico has reduced response time to oil spills, in some cases, to as little as 1 hour. This is particularly important in nearshore waters where environmentally sensitive habitats are at risk and quick response is important. Although response time is shortened, it should be noted that, on average, only about 20 to 40 percent of the volume of spilled oil is recovered with mechanical response equipment.

Budget reductions by these spill-response organizations have decreased private research and development on new oil-spill response technologies. However, the MMS maintains an oil-spill response research program with funds provided by the OPA 90 Oil Spill Liability Trust Fund. Major research is focused on spill containment, cleanup, behavior, and surveillance. Response equipment testing and standardization are done at the Oil and Hazardous Materials Simulated

Environmental Test Tank (OHMSETT) operated by MMS in Leonardo, New Jersey.

Pipeline and Seafloor .

New pipeline burial techniques have been developed to reduce bottom disruption and turbidity. Sidescan sonar traces are made of new pipeline routes to ensure minimal disturbance and to maximize pipeline safety.

More and better computer monitoring systems are being used offshore to detect leaks in the pipeline system, thus smaller quantities of oil are being lost to the ocean due to early detection and shutting down of the pipelines for repair.

Findings and Recommendations

This subcommittee was charged with reviewing and evaluating information needs for OCS areas that are currently under moratoria. The decisions that led to the recommendations in this report were based on careful consideration of the discussions presented and following observations:

- Future energy exigencies may lead to a demand to explore for and produce oil and natural gas in areas currently under moratoria.
- The current budget for environmental studies is not sufficient to adequately initiate new studies in moratoria areas.
- Methods of acquiring adequate environmental information have been established through the NRC review process, the ESP Scientific Committee advisory process, and internal MMS procedures.
- Safety and pollution prevention technology and procedures have been improved.
- Energy resources in the OCS consist of a mixture of oil and natural gas with most areas prone to one or the other.

Recommendation 1. The MMS should proceed with environmental studies in moratoria areas.

A recommendation by this subcommittee to proceed with environmental studies in moratoria areas does not indicate an endorsement for opening these areas in the future. However, several important factors were identified during the subcommittee's deliberations that lead to this recommendation. The NRC in its summary report *Assessment of the U.S. Outer Continental Shelf Environmental Studies Program, IV: Lessons and Opportunities* found that "a credible science program focused on environmental issues is essential to the success of the Nation's leasing, exploration, development, and production of OCS oil and natural gas resources in an environmentally sound manner." It concluded that the "recommendations of the previous reports in this series, concerning physical oceanography, ecology, and social and economic studies, should be fully implemented." Recommendations of the NRC provided basic guidance on information needs for addressing different stages of OCS activities, as well as information needs for differences in and between planning areas. This subcommittee recognizes that the MMS has used the NRC recommendations to focus and improve the ESP in moratoria areas, as well as throughout the Nation. The subcommittee recommends that the MMS continue its efforts to address environmental and social and economic study deficiencies noted by the NRC in determining study needs for moratoria areas. Recommendations of the NRC are summarized in appendix B.

Moratoria areas are recognized as potential valuable sources of oil and natural gas for this Nation. The MMS estimates that 45.6 billion barrels of undiscovered conventionally recoverable oil resources and 268 trillion cubic feet of undiscovered conventionally recoverable natural gas resources are located on the Federal OCS. Of this total, 33 percent of oil and 23 percent of natural gas are estimated to be in moratoria areas. Should the need (e.g., maintaining national energy security) or opportunity to explore and eventually develop and produce these resources occur in the future, the MMS must be prepared to predict, assess, and manage the impacts from oil and natural gas operations. Adequate environmental information is also necessary to determine appropriate mitigation/stipulations.

Environmental studies should focus on natural resource and other information that can be used by the MMS for

environmental, social, and economic analyses, as well as address key issues identified for particular study areas. Because the acquisition of adequate environmental information often takes years, it is necessary to begin studies with as much lead time as possible. Adequate lead time gives the MMS and others the opportunity to conduct studies necessary for making sound decisions on the OCS. However, environmental information that can become outdated should not be collected too early in the process. The collection of this information may need to wait until a decision to progress in moratoria areas has been made.

Natural resource information obtained by the MMS through the ESP is widely recognized as contributing significantly to the knowledge of the U.S. continental shelf. It is often used by a variety of Federal, State and local managers for the protection and management of ocean and coastal resources regardless of whether oil and natural gas activities occur. Because the acquisition of this information is of great value to many agencies, the MMS should continue to work with others in jointly obtaining and periodically updating data.

Recommendation 2. Congress should support environmental studies in moratoria areas with new funds.

The total funding for the MMS Environmental Studies Program has declined from a high of \$55.5 million in FY 1976 to \$25 million in FY 1986 to \$14 million in 1996. In addition, MMS must also use these limited funds for environmental studies to support expanded Federal sand and gravel activities.

Current ESP funding levels do not provide for adequate environmental evaluation of both nonmoratoria and moratoria areas. Dividing existing, limited funds among all areas will produce inadequate results and undermine the credibility of the program.

Recommendation 3. The MMS should request the funds necessary to initiate environmental studies in moratoria areas in its 1999 budget.

Because of the normal lag time between planning, initiating,

analyzing, and publishing scientific studies, the subcommittee recommends that environmental studies for moratoria areas be started as soon as possible. In addition, the subcommittee recommends that studies in moratoria areas be administered and directed by MMS. Studies in these areas will require a high level of direct interaction among MMS, stakeholders, and researchers. This interaction would be hindered by passing funds to bureaus such as USGS/BRD (formerly NBS). This subcommittee agrees with the OCS Scientific Committee in their strong objection, on both scientific and administrative grounds, to arrangements such as that with BRD.

Recommendation 4. The MMS should maintain, or have access to, up-to-date, basic information on oil and natural gas resources and natural resources within moratoria areas.

The MMS estimates that a substantial amount of oil and natural gas may exist in areas subject to moratoria. The MMS should continue to refine and update its assessment/inventory of oil and natural gas resources in all OCS planning areas using the most sophisticated technologies available. This information is necessary for making sound OCS leasing decisions.

The MMS should also maintain or have access to basic knowledge of important natural and cultural resources and oceanographic features in all OCS planning areas. This inventory, which should be in geographic information system (GIS) format where possible, should include data on fisheries, marine mammals, marine birds, cultural resources (such as marine sanctuaries or important shipwrecks), bathymetry, hard-bottom areas and other critical habitat, and key shoreline features. This information is especially important for estimating the potential environmental and social and economic impacts of OCS activities in frontier areas (i.e., where there has been no previous OCS exploration or development).

Recommendation 5. The MMS should establish a social and economic studies program that includes current data for all OCS areas, including moratoria areas.

As with natural resources, a basic level of social and economic

data should be collected in all regions and updated periodically as needed. Community concerns about the impacts of OCS development are often associated with the relative effects of increased employment and population, resulting from OCS development, on the private and public sectors of their community. Social and economic conflicts between resource users may also be a concern, such as between OCS development and tourism or commercial fishing. However, the economic effects of OCS development may also provide benefits to the community, if the development provides locally new jobs, taxes, and additional public revenues. It is important that MMS collect and analyze social and economic data in OCS areas subject to moratoria.

The NRC recommended that MMS establish a social and economic studies program to address OCS activities at all stages. The NRC further recommended that MMS delineate regional and subregional needs to define its research agenda. The MMS has conducted social and economic workshops in the Gulf of Mexico coastal States and California, and should expand these workshops to all OCS planning areas.

Recommendation 6. The MMS should maintain a knowledge of key issues and of information needs in moratoria areas.

The MMS should maintain a group of experts with a background and understanding of oil and natural gas resources, physical oceanographic processes, ecological systems, and social and economic concepts for in-house discussions and problemsolving. These experts, the regional directors, and the director of MMS should encourage and support open discussions with members of the Minerals Management Advisory Board (OCS Policy Committee, OCS Scientific Committee, and Alaska OCS Regional Offshore Advisory Committee) to identify key scientific issues and information needs. Dialog between staff members of MMS regional offices and university researchers should be encouraged and should include discussions concerning key issues and information needs in the regions. These discussions should be enhanced and expanded by including scientists from research institutions throughout the respective regions.

Recommendation 7. The subcommittee recommends that the MMS refine its generic process for identifying the studies required to be performed in moratoria areas to meet information needs and formulate a strategy for this process that includes affected States and other stakeholders, including industry. The MMS should be cognizant of all recent environmental studies, new technologies, and industry interest.

The MMS has developed region-specific hierarchical processes for identifying information needs and setting priorities on environmental studies. Due to a variety of factors, including recent scientific advances, changes in stakeholder groups, local and national politics, and changes in real and perceived risk, the regional study priorities may have changed in some planning areas. The MMS is encouraged to review existing approaches and develop a new strategy that could be used both on the regional and national level for identifying and selecting environmental studies critical to making future leasing decisions in moratoria areas. This strategy, due to the uncertainties regarding if or when moratoria might be lifted, may require slightly modified approaches from those used in the current ESP and involve all key stakeholders. Developing the strategy should include an update of existing information that would affect the leasing decisions. This should include both region-specific data, as well as general scientific information that is applicable, such as new information on the fate and effects of contaminants in the marine environment. A combination of electronic database searches and regional workshops could be used to gather the information.

The MMS should solicit and incorporate ideas, recommendations, and information from key stakeholders, including nongovernment organizations, Federal and State resource agencies, academic institutions, consultants, and city/county entities, as appropriate for the area. The MMS should incorporate all of this information and make primary use of the scientific staff and the OCS Scientific Committee in making final recommendations.

Funds for environmental studies in moratoria areas will likely be limited, and the geographical range of current moratoria areas is

quite large. Moratoria areas should be prioritized based on oil and natural gas resource potential and key environmental and social and economic issues. Within the highest priority areas, a process should be established to focus on critical environmental studies needs.

Recommendation 8. The MMS should continue to support the development of new and advanced technologies that improve operational performance and reduce environmental risk.

There have been numerous technological advances that enhance and improve all aspects of OCS operations from preleasing activities to platform removal. These advances have improved operational performance, reduced environmental risk, lowered operating costs, minimized environmental exposure, and mitigated environmental impacts. Major advancements have been made in geophysical resource assessment, drilling technology, drilling fluids and discharges, well completion and treatment, produced water and sediment, air quality, platform and pipeline design, communications, operational monitoring, and training. A technological priority has been in the area of oil-spill response and cleanup, and much has been accomplished. Although substantial progress can be measured in all facets of OCS activities, a concerted Federal-industry effort must continue in order to ensure that all OCS activities are performed in a manner that minimizes environmental impacts and maximizes the economic benefits to the Nation.

Recommendation 9. Environmental studies should be tailored to the different environmental risks associated with the production of oil versus natural gas.

The principal difference in environmental risk associated with the exploration and production of offshore oil versus natural gas production is the danger of accidentally spilled oil compared to the release of volatile natural gas. The hazards must be evaluated with regard to the environmental sensitivities of shorelines, wetlands, and marine mammals and other wildlife potentially exposed to the spilled oil. Many risks are site specific, and depend on the physical and chemical nature of the oil, the distances from sensitive areas, the nature of local ocean

currents and wind, and the equipment and resources available for oil cleanup and protection of sensitive areas. The fouling risks from accidental spills of natural gas are minimized by the volatile nature of the product, but the possible presence of condensates pose risks of water column contamination and fire hazard. Environmental risks from other aspects of offshore exploration and development, including exposure to muds and cuttings, air pollution from offshore operations, and produced water discharges, are similar for oil and natural gas production operations. The minimization of risks from these factors rely upon safety measures and improved technologies used in current industry operations as described in this report.

Recommendation 10. The MMS should support and expand environmental studies in cooperation with other Federal and State agencies, universities, and industry.

Reductions in budgets, as well as the need to use budget resources in areas where leasing is permitted, significantly limit the funds available for studies in moratoria areas. Cooperation with other Federal agencies as well as the agencies of State government and local universities will provide the MMS with an opportunity to leverage its limited funds in moratoria areas. However, cooperative funding efforts with these groups should not be done at the expense of the ESP budget and study priorities. The MMS coordination of the Federal-State cooperative research is important allowing MMS to learn directly about the environmental and social and economic conditions in these areas. Local expertise may be better able to identify questions and issues of local concern. Cooperation will address two additional concerns within moratoria areas. First, working with local governments and universities will permit the communities more of a stake in the research and more confidence in the results. Second, cooperation with other Federal and State agencies will allow MMS to pursue research goals within areas where moratoria currently limit such efforts.

End Notes

1. The 5-year program is required by section 18 of the OCS Lands Act, as amended, and represents the first step in the overall process governing leasing, exploration, development, and production of Federal offshore oil and natural gas resources. It is a schedule of proposed OCS lease sales indicating the size, timing, and location of leasing activity for the 5-year period following its approval.
2. Chemosynthetic communities are persistent, assemblages of marine organisms such as tube worms and mollusks. They are depend on bacteria which can convert chemical compounds found in hydrocarbon seeps into their primary food source. In the Gulf of Mexico, these communities are located at hydrocarbon seeps.
3. Pinnacles are “pointed” topographic features occurring singly or in groups extending from 2 to 60 meters above the ocean bottom. They support diverse marine communities. In general, the higher the relief of the pinnacle the greater the richness and diversity of marine life. In the Gulf of Mexico, they are common features of the Mississippi-Alabama continental slope area.